

NEW JERSEY DEPARTMENT OF TRANSPORTATION

NEW JERSEY DEPARTMENT OF TRANSPORTATION EXPERIENCE
WITH RECYCLED MATERIALS

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ABSTRACT

In the 1970's and 1980's the solid waste disposal problem in New Jersey slowly grew to crisis proportions. Solid waste regulations were developed and the New Jersey Department of Transportation was mandated to develop uses for Recycled waste materials. This paper describes the administrative steps taken to implement this program in NJDOT and highlights some of our successes.

INTRODUCTION

In the 1970's and early 1980's the State of New Jersey faced a crisis with regard to the disposal of waste material. The state has a high population density. Major urban centers are located adjacent to New York City in the northeast and adjacent to Philadelphia in the southwest. Generally, to the west of New York and to the east of Philadelphia the state slowly progresses to rural regions. As landfills were depleted, great resistance was encountered in the planning for new landfills. Political pressure became so strong that new landfills were not developed. In the 1970's it slowly became apparent that the state lacked sufficient landfill capacity to keep pace with the generation of new waste material. As an interim solution addressing this problem New Jersey started to ship its waste material to adjacent states. In some cases landfills as far away as Ohio and Indiana were utilized. Needless to say, the disposal of waste progressively became more expensive.

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Eventually, the people of Midwestern states resisted the intake of New Jersey waste.

The composition of the task group was designed to specifically include

LEGISLATIVE MANDATE

In order to deal with this problem, the New Jersey Assembly passed P. L. 1987, Chapter 102, "An Act Concerning Mandated Statewide Source Separation and Recycling of Solid Waste". This legislation required the recycling of as much waste material as possible. It included, among other things, that private citizens be required to separate glass, aluminum, plastics and newspapers from their garbage and recycle it through Municipal and County recycling centers.

This legislation also directed that "...The Commissioner of Transportation should review and modify all paving material and subbase specifications to utilize recycled materials".

RECYCLED MATERIALS TASK GROUP

In order to meet this legislative mandate, the Department established a specialized task group which continues to meet every month. The objective of the task group is to expedite the time-consuming process required for material evaluation and specification development. Normal evaluation and specification writing methods might span several years from the start of research to the actual implementation of a specification. The goal of this group was to shorten this process and

still maintain a high level of reliability in the developed specifications.

The composition of the task group was designed to specifically include Bureau Chief level representatives from each of the following Bureaus.

Materials

Geotechnical Services

Plans and Specifications

Maintenance

Research

Environmental Protection

Construction

Structures

Personnel from each of these operating units might be assigned to work on evaluating projects at the discretion of the Bureau Chief. These assignments are made on the basis of the expertise needed to evaluate each project. Additionally, membership of the task group includes the Material Bureau's Bituminous Engineer.

The Secretary of the New Products Committee is also a member of this task group. The State's four Regional Materials Engineers are members as well. These representatives, as well as the Bituminous Engineer and the Research Engineer, have been leaders in the evaluation of recycled materials projects. Finally, the Department of Environmental Protection (DEP) is also represented.

A Federal Highway Administration Division Representative is also a member of the task group. His presence leads to the early resolution of potential problems which might require Federal Highway Administration approval, such as specification changes and project change orders.

New Jersey's private industry is represented on this task group by a representative of the New Jersey Alliance for Action. This organization is a broadly based lobbying agency that actively promotes economic development in the State of New Jersey. Membership in the Alliance includes the New Jersey Asphalt Paving Association, New Jersey Concrete and Aggregate Association, the Association of General Contractors, the Reinforced Concrete Pipe Association, and numerous other material supplier organizations. In addition to the construction industry, there is also broad representation among recycling centers and industrial activities within the state.

The Department's organizational structure is such that the Recycling Materials Task Group reports collectively to: the Assistant Commissioner for Design, the Assistant Commissioner for Planning, and the five Regional Executive Directors. The task group also maintains a liaison relationship with the New Products Committee.

NEW PRODUCTS COMMITTEE LIAISON

The New Products Committee is an internal committee that reviews and evaluates new products proposed for use on NJDOT projects. In fact the

New Products Committee acts as a screening agent for product evaluation. Products offered to the Department are first evaluated by the New Products Committee and then, if appropriate, forwarded to the Recycling Task Group.

TASK GROUP SUBDIVISION

The task group is subdivided into three general groups. The first is full membership which was described earlier. This full membership meets on a monthly basis and all business that the task group carries out is handled at these meetings. In dealing with new recycled products, the task group will discuss each item and, if it anticipates feasibility, will establish a product evaluation subgroup. This subgroup is drawn from the full membership and will include the specialists who have expertise in the applicable field. Again, candidates for this subgroup are selected from throughout the Department. This subgroup will then determine a path to be followed in evaluating the recycled product. This process will include the choice of a project for the installation of the product, test sections, and a time schedule. Also involved is the development of a test protocol to evaluate the product's performance. As a matter of practice at least two field installations are programmed for each promising recycled product. Once the installations are complete and the testing has been finalized, the subgroup determines whether the product should be recommended for further use.

The specification subgroup is activated upon a successful report from the evaluation subgroup. The specification subgroup is chaired by the Bureau Chief of the Bureau of Plans and Specifications. He forms a group consisting of individuals from his staff or the task group who have expertise in the area of interest. They meet promptly and draft a trial specification. This draft then goes into the Department's routine Specification analysis system. It is circulated among all of the operating units within the Department for review and comment. This process normally takes from four to six weeks. Because the Chairman of the subgroup expedites its handling, it is often possible to write a specification and process it through the system within as short a time as two months.

The Recycled Materials Task Group has also developed an accelerated specification rewriting system. This involves a very rapid handling of specification rewrites when an evaluation of a product indicates that such modifications of specifications are necessary. This is accomplished by continuous early evaluation of recycled product installations. It is possible to accomplish an accelerated specification change in as little as 6 weeks.

DEPARTMENT OF ENVIRONMENTAL PROTECTION INTERPLAY

Special attention has been given to the relationship between the DOT and the Department of Environmental Protection (DEP). We have learned that in some ways the DOT and the DEP seem to act parochially within their various disciplines. By this I mean that the Air Quality people at DEP

might not be aware of the concerns of the Water Quality people, and vice versa. This situation has led to problems where the task group working with one DEP unit finds out late in this process that the specification does not meet the requirements of another DEP unit. Needless to say, these confusions cause delays in the process. In order to resolve this, all of the DEP operating units have been asked to participate in the task group. Usually, it is not practical for so many representatives to attend.

The representative of the Office of Recycling is a full time DEP member on the task group. This member has been instrumental in resolving the problems discussed above. He makes sure that the relevant parties in DEP are apprised of meetings when the agenda includes items germane to their area of expertise. Additionally, the Office of Recycling member has been instrumental in resolving problems because he is, by the nature of his job, proactive in promoting the use of recycled materials.

By including this DEP membership, it is possible to resolve environmental problems very early on in the specification development process. Nevertheless, certain recycled products have presented genuine environmental problems. In these cases the only alternative is to prohibit the use of that product.

INDUSTRY INVOLVEMENT

In order to make this recycling program as effective as possible it was necessary to actively engaged with industry in the process. This

interaction involves the construction industry, the recycling industry, and private industry as a whole. These three groups represent user, processor and source, respectively. Liaison with these three groups is maintained through the membership of the New Jersey Alliance for Action. While this member does not vote, it acts in two important capacities. The first is the introduction of recycling sources to the task group. These introductions are in the form of either a formal presentation before the task group or in the submission of an application through the New Products Committee. Secondly, the Alliance for Action representative disseminates information from the task group to industry. Once a specification is developed, it is important to quickly inform industry. These functions are critical to the effectiveness of the task group.

INCENTIVE PLANS

The task group further involves industry through the development of various incentive plans. These plans are designed to promote the use of a specific recycled product. Once the use of the product is established, the Department's incentive also is discontinued. An example in progress is the glassphalt incentive program. Glassphalt was introduced on an experimental basis on two projects in 1990 and 1991. When these installations were found to be effective, a specification was written and an incentive program implemented for the 1992 construction season. During 1992, six projects were advertised with the alternative item of asphalt concrete with 10% glass. The Department further specified that it would pay an incentive of \$1.00 per ton if the

contractor elected to use this glassphalt. Of these six projects, three contractors took advantage of the alternate design. The Department intends to continue the glassphalt alternate program for all asphalt construction projects awarded in the near future. It is believed that the glassphalt product will be a competitive alternate even without the Department's incentives.

MARKET FORCES

It is the intention of the NJDOT to allow market forces to determine whether a virgin product or a recycled product would be used in a given circumstance. This approach has been quite effective in identifying the most economical material to perform a job. An example of this factor is the use of recycled concrete aggregate (RCA) as an alternate for dense graded aggregate base course (DGABC). Once it was determined that the performance of RCA was equivalent to virgin DGABC, the specification was rewritten permitting the use of RCA as an alternative. Over the five or so years that this specification has been in operation market forces have led to the use of approximately 10 to 15% RCA as a substitute for DGABC applications each year. The decision as to which material was used was made exclusively by the contractor and presumably was based on cost. The concept of market forces controlling the use of recycled materials is fundamental to the Department's recycling program.

POSITIVE COMMITMENT BY DOT

The Department feels that its commitment to the unbiased evaluation and use of recycled products is very important in eliciting the participation of industry in this process. By developing and advocating different recycled products and processes, the Department has demonstrated its resolve. We believe that industry in-turn feels that it is acting more as a partner in the development of these recycled processes, rather than as the sole originator of recycled products. In recent years the Department has successfully implemented several recycled products. Some of our accomplishments are:

- The NJDOT permits the use of Recycled Asphalt Pavement (RAP) as an alternate in Hot Mixed Asphalt. Although this is a relatively long term program, having started in the late 1970, it makes a significant contribution to the quantity of material that is recycled and that might otherwise have consumed land fills.

Current specifications permit the use of 10% RAP in all surface course mixes and 25% RAP in base and binder course mixes. There is no control on the source of this RAP material. (This is an open system.) On projects where a large amount of RAP will be generated by milling from the project site, the Department permits the use of up to 15% RAP in surface course and from 26% to 50% RAP in base and binder courses. (Closed system RAP projects are allowed greater percentages in recycling.)

This program has been very successful, and in an average year approximately 55 thousand tons of RAP are used. One hundred and thirty-five thousand tons were used in 1992.

- The NJDOT permits the use of fly ash, a waste product from stack collection systems at coal fired electric generating plants. The Department permits the use of this material as an additive in Portland Cement Concrete and as a mineral filler in hot mix asphalt pavements. Reductions in fly ash stock piles have been observed as a result of these uses. Two additional benefits occur with the use of fly ash as an additive in portland cement concrete. Fly ash acts to mitigate potential alkali silica reaction problems, and improved long term concrete compressive strength also results.
- The NJDOT has evaluated and now permits the use of Recycled Concrete Aggregate (RCA) and Crushed Vitreous China as an alternate for DGABC. This material is derived from waste concrete removed from project or demolition sites and from industrial waste sites. It is processed by crushing, classifying, and recombining, to meet the same gradation requirements for virgin DGABC. The same quality requirements as those for DGABC apply, with the exception of permitting up to 10% asphalt concrete in the material.

Prior to this recycling program, all concrete waste and Vitreous China were disposed of in land fills. Now not only does the Department alleviate pressure on the land fills, but so do other agencies. RCA and Crushed Vitreous China use is broadly accepted

by County and Municipal jurisdictions and in commercial applications.

The NJDOT has developed a specification that permits the use of broken container glass in hot mix asphalt. The use of 10% broken container glass in base and binder courses is allowed. Initially, the glass was required to be from broken containers, pass a 3/4" sieve and an anti-stripping agent was required. However, we learned that little benefit was derived from the use of the anti-stripping agent. The requirement was therefore changed to 100% passing the 3/8" sieve and the anti-stripping agent was dropped. This measure has been effective in reducing pop outs where base and binder courses have been opened to traffic, and it has removed the need for an extra asphalt storage tank at the batching plant. Eliminating the need for an extra tank removed a significant impediment to the broad use of glassphalt in the state.

- The NJDOT has been performing research on Crumb Rubber Modified Asphalt (CRMA) since 1984. In that year a test section of Plusride rubber asphalt was placed on a project. Approximately 3% rubber was used in the surface course mix. At this time, eleven years later, the Plusride rubber asphalt is performing in a manner equivalent to the control section. In 1991 and 1992 two additional research projects using the Rouse wet process were placed. With the exception of the rubber asphalt sticking to compaction rollers, no batching or constructability problems were encountered on these projects.

During the 1993/1994 construction season, the Department installed CRMA on four projects. These used the McDonald, Plusride, Rouse and Generic Systems. The cumulative CRMA placed on these four projects exceed the CRMA requirements for 1994 under ISTEA. This represented approximately 45,000 tons of CRMA. One or two CRMA projects are planned for 1995.

The state government has passed a law which will require CRMA to be used on state funded projects at the same percentage rates as those in ISTEA for federally funded projects. The schedule of implementation, however, escalates to 40 percent in the year 2001.

- New Jersey generates approximately 10 million used tires each year. It is estimated that with full implementation of both state and federal CRMA programs in 2001, 750 thousand used tires will be consumed. Although this only represents a small percentage of the used tires generated, it is a good start towards responsible disposal.
- The NJDOT has evaluated the use of asphalt cold patch material that was manufactured from demolition roofing material. Patch material installed in a very shallow patch location only started to show signs of distress after 22 months of service. The traditional NJDOT cold patch material generally lasts a short three to six months. This is obviously a very promising product. Department

Maintenance now have open contracts for the use of this material. Maintenance is very happy with the performance of this product.

- The use of wood chips generated from clearing project sites is permitted as a landscaping material. While this is a simple item, it makes a significant impact on reducing solid waste land fill needs.

The Department has a number of other recycled materials still under evaluation. These are:

The use of Remediated Petroleum Contaminated soils in hot mix asphalt. One of the processes to remediate petroleum contaminated soils is to run that soil through the drier at hot mix asphalt plants. This process volatilizes the petroleum contaminant and the soil is no longer defined as a hazardous waste material. Because the soil material is already at an asphalt batching plant, it seemed only logical to try using this soil in asphalt paving mixtures. To date this material has been used on three projects, two at a 10% and the other at a 20% remediated soil level. All projects have been successful, although, there have been relatively high clay contents in the soil.

The great majority of these remediated soils are used as embankment. While the evaluation program is not complete, the NJDOT expects this process will be widely accepted.

- A process known as Cyclean permits the use of up to 100% RAP in the fabrication of hot mix asphalt. During 1993 construction season, the NJDOT scheduled a large Interstate project which allowed this process as an alternate to standard materials. While this alternative was not chosen, other states have used this process and report economic and performance successes.
- The NJDOT has experimented in the use of RCA and RAP as a percentage additive in soil aggregate uses where the soil aggregate is intended to perform above the ground water table. Early reports on those uses are promising. A specification has been developed for the use of RAP in DGABC and it will be fully implemented during the next construction season.
- The Department has experimented in the use of broken container glass of mixed color as an additive in (DGABC). At additions of approximately 25 percent, this DGABC did not appear to exhibit the same level of stability as virgin DGABC. At the same time, standard quality evaluation tests do not indicate any reduction in quality. The Department is planning another project where the additive rate will be 10 percent.
- A major research study is underway in New Jersey where incinerator ash will be incorporated into hot mix asphalt. This study is

planned for this construction season and is sponsored by the NJDOT, NJDEP, Port Authority of NY and NJ, the NJ Turnpike Authority, the Long Island Regional Planning Authority and the Garden State Parkway Authority. Fifteen percent incinerator bottom ash will be used in Hot Mix Asphalt and an extensive study of the environmental impact of this material will be carried out.

- There is a program to evaluate recycled water that was used to clean portland cement concrete batching trucks and plants. The quality of this reclaimed water will be measured and it is hoped that eventually the water would be clean enough to be used as mixing water in portland cement concrete.
- Roofing shingles are being evaluated as additives to two different products. The first is an additive produced from asphalt shingle production waste and then introduced to hot mix asphalt. These tab cut outs are processed by grinding prior to their introduction to the hot mix asphalt in a pug mill. Three projects incorporating this product have been placed. Although these projects are on a small scale, there has been no indication of any batching or constructability problems. Long term evaluation of this process will be required.

The second product is the use of an additive manufactured from demolition roofing waste that is used in hot mix asphalt. Our evaluation of this product is just starting, but early indications are that because of the increased stiffness of roofing asphalts and

the presence of fiber material, it might be desirable to use this material in areas that will be susceptible to rutting. Environmental questions regarding this process are now being resolved.

- The NJDOT has scheduled a project for this construction season where flowable fill will be used to backfill utility ditches. This material is supplied as a ready mix concrete product. It consists of sand, fly ash, portland cement and water. It is mixed to a wet consistency and permitted to flow into the utility excavation. The material acts as a liquid in seeking its own level, and then sets quickly to relatively low compressive strengths. Flowable fill will support traffic upon setting, and it is easy to excavate. This represents another potential use of fly ash.
- The NJDOT is planning to use chunks of rubber tires as light weight fill material, or simply as an additive to soil aggregate materials. These potential uses may further deplete the annual flow of used tires.
- The use of used rubber tires as fuel is recognized for its potential importance, although this lies outside the Department's scope of responsibility.
- A study of the use of used rubber tires as a mechanism to mitigate river scour is underway.

- The DOT in conjunction with the DEP has started the evaluation of the potential use of composted sewer sludge as a top soil enhancer. A trial installation of this material in highly granular top soil is underway. Grass growth will be studied to establish optimum additive rates.
- The DOT is considering the installation of a noise wall made from recycled plastics and supported by a case of soil. The potential for a use of this type is tremendous and might even evolve to the mining of existing landfills to secure the raw plastic material.

There are a number of other applications of recycled materials that NJDOT is considering. These include: processed medical glass waste, recycled plastic products, numerous rubber products, wood and plastic combination products, and others.

CONCLUSION

I want to discuss an issue that has come to my attention on several occasions. This is the risk that the products and processes developed in this rapid evaluation system might not perform as anticipated and, therefore, result in system failures. This accelerated process does, of course, remove some safeguards presently in the New Product Evaluation system. It is felt that the degree of risk taken in this rapid evaluation system is tolerable because:

1. The applications of recycled products are relatively safe. For example, the use of 10% glass in hot mix asphalt and the use of RAP as a base course are not radical experiments.
2. For each product, at least two trial installations are made before an evaluation is completed. If problems occur, further development is not pursued.
3. Management of the New Jersey Department of Transportation has tried to instill the concept of risk taking as a method to promote innovation.

The goal of the 1987 Recycling of Solid Waste Law was to achieve 60 percent recycling by the year 1995. The State of New Jersey recycled approximately 53 percent of all the solid waste generated within the State in 1993. In that same year construction debris represented 17% of all solid waste generated. Ninety three percent of this construction debris was recycled. It looks like we will meet our goal and we feel that the NJDOT has made a significant contribution by developing uses for many of the recycled materials that are generated.

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1. The application of recycled products are relatively safe. For example, the use of 10% glass in hot mix asphalt and the use of 5% as a base course are not radical experiments.

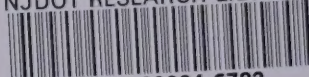
2. For each product, at least two trial installations are made before an evaluation is completed. If problems occur, further development is not pursued.

3. Management of the New Jersey Department of Transportation has tried to install the concept of 15% taking as a method to promote innovation.

The goal of the 1987 Recycling of Solid Waste law was to achieve 50 percent recycling by the year 1995. The State of New Jersey recycled approximately 51 percent of all the solid waste generated within the State in 1992. In that same year construction debris represented 17% of all solid waste generated. Ninety three percent of this construction debris was recycled. It looks like we will meet our goal and we feel that the NJDOT has made a significant contribution by developing uses for many of the recycled materials that are generated.

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